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(54) Title: METHOD OF HANDLING NETWORK-INITIATED CALLS IN A RADIO TELECOMMUNICATIONS NETWORK

(57) Abstract

A method of delivering a system-initiated call to a called mobile station in a radio telecommunications network following an unsuccessful initial attempt. The method implements several levels of call control. In level-1, a time delay is implemented (90) between call attempts. The method reattempts delivery of the call (110) at the expiration of the time delay (100) or if the mobile station accesses the network before the time delay expires (120). A call-attempt counter is incremented when each delivery attempt is made (110). The delivery attempts are stopped (80) when the call-attempt counter equals a predefined maximum number of call attempts (70). In level-2, a threshold level of channel availability in the network is defined (21), and the method attempts an initial delivery of the system-initiated call to the called mobile station (40) when the actual channel availability in the network is above the threshold level of channel availability (22). If the actual channel availability is below the threshold, the system-initiated call is delayed until the actual channel availability rises above the threshold level of channel availability (23). In level-3, a priority is set for each type of call in the network (30). If the system-initiated call is not the highest priority call to be delivered (31), higher priority calls are delivered first (32). If the system-initiated call is the highest priority call to be delivered, the method attempts to deliver the system-intitiated call first. The priority may be based upon each call's revenue-generating potential, subscriber priority, or age of the call.

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METHOD OF HANDLING NETWORK-INITIATED CALLS IN A RADIO TELECOMMUNICATIONS NETWORK

BACKGROUND OF THE INVENTION

Technical Field of the Invention

This invention relates to telecommunication systems and, more particularly, to a method of handling network-initiated calls to mobile stations in a radio telecommunications network.

Description of Related Art

In existing radio telecommunications networks, certain calls to mobile stations are initiated by the network itself when triggered by defined events. Such "system-initiated calls" may include, for example, a call which is initiated by a service node or a Service Control Point (SCP). Such a call may be made to a subscriber on a predefined date with a reminder of an upcoming event. Another example is a Message Waiting Indicator (MWI) call which is initiated by the network when a subscriber has a voice mail message waiting to be read.

In many existing networks, the serving Mobile Switching Center (MSC) continuously reattempts MWI calls until the subscriber answers. This process of continuously reattempting MWI calls is often a great waste of network resources. Each call attempt involves paging for the mobile station and determining if there is a page response. When there is no page response, repeating this process needlessly utilizes paging and processing resources in the serving MSC. If the subscriber's mobile station is turned on and is responding to pages, each call attempt involves the seizing of a voice channel, and sending an alerting signal to the mobile station. If the subscriber is not answering, repeating this process uselessly ties up network resources. In addition, it causes increased drain on the mobile station's battery.

While MWI calls are handled entirely within the serving MSC, other types of system-initiated calls may utilize additional network resources. If the reattempt was initiated in a service node, for example, then network signaling capacity is impacted,

and a trunk may be needlessly seized to the MSC for each call attempt. During periods when the network is congested, repeated attempts to place MWI calls can be very burdensome on the network and often prevent revenue-generating calls from being placed because of the lack of an available traffic channel.

Although there are no known prior art teachings of a solution to the aforementioned deficiency and shortcoming such as that disclosed herein, U.S. Patent Number 5,313,515 to Allen et al. (Allen) and PCT Patent Application WO 95/01067 to Remy (Remy) discuss subject matter that bears some relation to matters discussed herein. Allen discloses a cellular telephone network which stores voice mail messages in a voice messaging center, and then transmits a message waiting flag for the called mobile station to the serving exchange (MSC). The serving MSC places a MWI call to the mobile station when it registers with a cell of the network and/or if it initiates an outgoing call. Allen makes no provision for reattempting the MWI call if it is unsuccessful, but teaches instead making only one attempt.

Remy discloses a method of handling MWI calls in which repeated delivery attempts are made. Remy implements time delays between the call attempts. The delays can be a function of the time of day, date, and availability of the called subscriber. Remy, however, does not teach or suggest the present invention.

Review of each of the foregoing references reveals no disclosure or suggestion of a method such as that described and claimed herein.

In order to overcome the disadvantage of existing solutions, it would be advantageous to have a method of handling system-initiated calls in which a call counter limits the number of call attempts, the availability of traffic channels determines whether system-initiated calls are attempted, and/or pending calls are prioritized according to revenue-generating potential or other criteria. The present invention provides such a method.

SUMMARY OF THE INVENTION

In one aspect, the present invention is a method of delivering a system-initiated call to a called mobile station in a radio telecommunications network. The method begins by attempting an initial delivery of the call to the called mobile station. If the call is successfully delivered, the process stops. However, if the call is not delivered,

a time delay between call attempts is measured, and the method reattempts delivery of the call at the expiration of the time delay, or if the mobile station accesses the network before the time delay expires. The method also includes incrementing a call-attempt counter when each delivery attempt is made, and stopping the method upon determining that the call-attempt counter equals a predefined maximum number of call attempts.

In another aspect, the present invention is a method of delivering a system-initiated call to a called mobile station in a radio telecommunications network which includes the steps of attempting an initial delivery of the call to the called mobile station, incrementing a call-attempt counter upon attempting the initial delivery of the call, and determining whether the initial attempted delivery was successful. If the initial attempted delivery was successful, the method stops. If the initial attempted delivery was unsuccessful, the method then determines whether the call-attempt counter equals a predefined maximum number of call attempts. This is followed by starting a timer to determine a time delay between call attempts, upon determining that the call-attempt counter does not equal the predefined maximum number of call attempts. The method then determines whether the time delay has expired, and reattempts delivery of the call, upon determining that the time delay has expired. If the time delay has not expired, it is determined whether the called mobile station has accessed the network, and if so, the method reattempts delivery of the call. The method increments the call-attempt counter upon each reattempted delivery of the call, and stops upon determining that the call-attempt counter equals a predefined maximum number of call attempts.

In yet another aspect, the present invention is a method of delivering a system-initiated call to a called mobile station in a radio telecommunications network which begins by setting a threshold level of channel availability in the network (or parts of the network such as a cell), detecting an event triggering the system-initiated call, measuring actual channel availability in the network upon detecting the triggering event, and determining whether the actual channel availability is below the threshold level of channel availability. If the actual channel availability in the network is above the threshold level of channel availability, the method attempts an initial delivery of the system-initiated call to the called mobile station. If the actual channel availability

in the network is below the threshold level of channel availability, the method delays the system-initiated call until the actual channel availability in the network rises above the threshold level of channel availability.

In still another aspect, the present invention is a method of delivering a system-initiated call to a called mobile station in a radio telecommunications network comprising the steps of setting a priority for each call in the network, and determining whether the system-initiated call is the highest priority call to be delivered. If the system-initiated call is not the highest priority call to be delivered, the method delivers higher priority calls. If the system-initiated call is the highest priority call to be delivered, the method attempts to deliver the system-initiated call. The priority may be based upon each call's revenue-generating potential or other criteria.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and its numerous objects and advantages will become more apparent to those skilled in the art by reference to the following drawings, in conjunction with the accompanying specification, in which:

FIG. 1 is a flow chart illustrating the steps of the method of the present invention when level-1 control is implemented;

FIG. 2 is a flow chart illustrating the steps of the method of the present invention when level-2 control is implemented according to the teachings of the present invention; and

FIG. 3 is a flow chart illustrating the steps of the method of the present invention when level-3 control is implemented according to the teachings of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS

The present invention is a method of handling Message Waiting Indicator (MWI) calls and other system-initiated calls. The method provides a great deal of flexibility, and may be implemented in varying degrees of control by the network operator. By implementing a more efficient process for handling system-initiated calls, network resources are freed up for other revenue-producing calls.

At a first level of control, the method immediately attempts to deliver the call

upon the occurrence of a triggering event. For MWI calls, the triggering event is the storage of a voice mail message for the called subscriber. For other system-initiated calls, the triggering event may be the receipt of a prompt in the serving MSC from a Home Location Register (HLR), a Service Control Point (SCP), or other network node. If the first delivery attempt is unsuccessful, the method implements a time delay before another attempt is made. The delay may be variable depending on the time of day, day of the week, etc. If the mobile station makes a system access during the delay period, the system-initiated call is immediately initiated in an attempt to complete the call.

The time delay is implemented with a timer in the serving MSC when the system-initiated call process is autonomous in the MSC. In addition, a system-initiated call counter in the serving MSC may be programmed to initiate a predefined number of reattempts, and to stop the reattempts if the predefined number is reached. If the system-initiated call is prompted by a network node other than the serving MSC, the reattempts are generally made only when additional prompts are received in the serving MSC. For example, if the first prompt is received from a SCP, the serving MSC may notify the SCP that the first attempt was unsuccessful. The SCP may be programmed to initiate a predefined number of reattempts at predetermined times or time intervals, and to stop the reattempts if the predefined number is reached.

At a second level of control, the initial system-initiated call may also be delayed if the number of available channels in the network is below a predefined threshold. A resource availability threshold is determined and set in the network. If resource availability is determined to be too low (i.e., the availability of traffic channels is assessed to be below the resource availability threshold), the method delays the system-initiated call until the number of available channels in the network is above the threshold. When the number of available channels in the network rises above the threshold, the method attempts to deliver the system-initiated call. The method may continue to measure resource availability in the network, and continue to attempt delivery of the system-initiated call. If the resource availability in the network falls below the threshold, and the system-initiated call has not been successfully delivered, the method may once again delay the system-initiated call until resource availability rises. In this way, revenue-generating calls are handled before system-

initiated calls which are generally not revenue-generating calls. Level-2 control may be implemented alone or integrated with level-1 control by implementing the counter and time delays of level-1 after the network resource availability has risen above the threshold.

In some cases, however, system-initiated calls may be revenue-generating calls. In this case, a third level of control is entered. A prioritization scheme is established for call delivery which may consider such factors as the revenue-generating potential of each call in the queue (the call with the highest revenue-generating potential being attempted first), subscriber availability, subscriber priority, and age of the system-initiated call (for example, the priority of the system-initiated call may be increased the longer the call waits for delivery). Under the prioritization scheme, if a mobile station responds to a page during an attempt to deliver a system-initiated call, but the subscriber does not answer, the method may continue attempting to deliver the call before proceeding with lower priority calls since the subscriber is probably close by and is likely to answer subsequent calls. However, if the mobile station does not respond to the page, then the subscriber probably has the mobile station turned off. In this case, the method delays any reattempts of the system-initiated call because they are unlikely to be successful, and proceeds to process other calls. At the expiration of a predetermined time delay, or when all of the other calls have been delivered, the method may again attempt the system-initiated call. If a revenue-generating call of higher priority than the system-initiated call is queued at any time, the method is preempted, and the higher revenue-generating call is attempted. Level-3 control may be implemented alone or integrated with level-1 and/or level-2 control.

FIG. 1 is a flow chart illustrating the steps of the method of the present invention when level-1 control is implemented. At step 10, an event such as the storage of a voice mail message for a called subscriber triggers a system-initiated call. At step 20, a system-initiated call counter is programmed with a maximum number of call attempts and then set to zero (0). At step 40, the system-initiated call is attempted and the counter is incremented. At step 50 it is determined whether or not the call was successfully completed. If so, the process stops at step 60, and then returns to step 10 and awaits another triggering event.

If the call attempt is not successful at step 50, the process moves to step 70 where it is determined whether or not the call counter equals the predefined maximum number of call attempts. If so, the process stops at step 80, and then returns to step 10 and awaits another triggering event. If the call counter has not yet reached the predefined maximum number of call attempts, the process moves to step 90 and starts a time delay timer. At step 100, it is determined whether or not the timer has expired. If the timer has expired, the process moves to step 110 where the call is reattempted, and the counter is incremented. However, if the timer has not expired, the process continues to delay the call and moves to step 120 where it is determined whether or not the called mobile station has made a system access. If so, the process moves to step 110 where the call is reattempted, and the counter is incremented. However, if the mobile station has not made a system access, the process continues to delay the call and returns to step 100.

Following the call reattempt at step 110, the process moves to step 130 where it is determined whether or not the call was successfully completed. If so, the process stops at step 140, and then returns to step 10 and awaits another triggering event. If the call attempt was not successful, the process returns to step 70 and repeats the process.

FIG. 2 is a flow chart illustrating the steps of the method of the present invention when level-2 control is implemented according to the teachings of the present invention. Although level-2 may be implemented alone, in the embodiment shown, level-2 is integrated with level-1 (i.e., as additional steps which are added to the method of FIG. 1).

In level-2 control, as noted above, the initial system-initiated call may also be delayed if the number of available channels in the network is below a predefined threshold. Therefore, from step 20 of FIG. 1, the process moves to step 21 of FIG. 2 where a resource availability threshold is set. At step 22, it is determined whether or not the number of available channels in the network is below the predefined threshold. If not (i.e., channels are available), the process moves to step 40 of FIG. 1 and continues with level-1 control. However, if the number of available channels in the network is below the predefined threshold, the process moves to step 23 and delays the system-initiated call until it is determined at step 22 that the number of available

channels in the network has risen above the threshold. Alternatively, if level-3 control is implemented, the process moves from step 23 to level-3 control as shown in FIG. 3.

FIG. 3 is a flow chart illustrating the steps of the method of the present invention when level-3 control is implemented according to the teachings of the present invention. Although level-3 may be implemented alone, in the embodiment shown, level-3 is integrated with level-1 and level-2 (i.e., as additional steps which are added to the method of FIGS. 1 and 2).

Referring now to FIG. 3, at step 30, the various calls in the network, including system-initiated calls, are prioritized according to their revenue-generating potential. At step 31, it is determined whether or not the system-initiated call is the highest revenue-generating call which is pending. If not, the process moves to step 32 where higher revenue calls are attempted first. The process returns to step 31, and if the system-initiated call is then the highest revenue-generating call, the process moves to step 33 where the system-initiated call is attempted. At step 34, it is determined whether or not the call was successfully completed. If not, the process moves to step 35 and continues to process other calls for a predetermined time delay. At step 36 it is determined whether or not the time delay has expired. If not, the process continues to process other calls. However, if the time delay has expired, the process returns to step 31, determines the highest revenue-generating call, and continues the call delivery process.

If it is determined at step 34 that the system-initiated call was successfully completed, the process stops at step 37, and then returns to step 10 of FIG. 1 to await another triggering event.

While the preferred embodiment shown prioritizes calls based on their revenue-generating potential, other bases for prioritization such as subscriber availability, subscriber priority, and age of the system-initiated call may also be utilized, and remain within the scope of the present invention.

It is thus believed that the operation and construction of the present invention will be apparent from the foregoing description. While the method shown and described has been characterized as being preferred, it will be readily apparent that various changes and modifications could be made therein without departing from the

scope of the invention as defined in the following claims.

WHAT IS CLAIMED IS:

1. A method of delivering a system-initiated call to a called mobile station in a radio telecommunications network comprising the steps of:

attempting an initial delivery of the call to the called mobile station;

determining whether the initial delivery attempt was successful;

stopping the method upon determining that the initial delivery attempt was successful;

establishing a time delay between call attempts, upon determining that the initial delivery attempt was not successful;

reattempting delivery of the call, upon determining that the time delay has expired;

reattempting delivery of the call, upon determining that the mobile station has accessed the network before the time delay expires;

stopping the method upon determining that the reattempted delivery was successful;

incrementing a call-attempt counter when each delivery attempt is made;

determining whether the call-attempt counter equals a predefined maximum number of call attempts;

repeating the steps of establishing a time delay between call attempts, reattempting delivery of the call, and incrementing the call-attempt counter, upon determining that the call-attempt counter does not equal the predefined maximum number of call attempts; and

stopping the method upon determining that the call-attempt counter equals a predefined maximum number of call attempts.

2. A method of delivering a system-initiated call to a called mobile station in a radio telecommunications network comprising the steps of:

attempting an initial delivery of the call to the called mobile station;

incrementing a call-attempt counter upon attempting the initial delivery of the call;

determining whether the initial attempted delivery was successful;

stopping the method upon determining that the initial attempted delivery was successful;

determining whether the call-attempt counter equals a predefined maximum number of call attempts, upon determining that the initial attempted delivery was not successful;

starting a timer to measure a time delay between call attempts, upon determining that the call-attempt counter does not equal the predefined maximum number of call attempts;

determining whether the time delay has expired;

reattempting delivery of the call, upon determining that the time delay has expired;

determining whether the called mobile station has accessed the network, upon determining that the time delay has not expired;

reattempting delivery of the call, upon determining that the called mobile station has accessed the network;

incrementing the call-attempt counter upon each reattempted delivery of the call;

repeating the steps of starting the timer, reattempting delivery of the call, and incrementing the call-attempt counter, upon determining that the call-attempt counter does not equal the predefined maximum number of call attempts; and

stopping the method upon determining that the call-attempt counter equals a predefined maximum number of call attempts.

3. A method of delivering a system-initiated call to a called mobile station in a radio telecommunications network comprising the steps of:

setting a threshold level of channel availability in the network;

detecting an event triggering the system-initiated call;

measuring actual channel availability in the network upon detecting the triggering event;

determining whether the actual channel availability in the network is below the threshold level of channel availability in the network;

attempting an initial delivery of the system-initiated call to the called mobile

station, upon determining that the actual channel availability in the network is above the threshold level of channel availability; and

delaying the system-initiated call until the actual channel availability in the network rises above the threshold level of channel availability, upon determining that the actual channel availability in the network is below the threshold level of channel availability in the network.

4. The method of delivering a system-initiated call of claim 3 further comprising the steps of:

determining whether the initial attempted delivery was successful;

remeasuring actual channel availability in the network upon determining that the initial attempted delivery was not successful;

determining whether the remeasured actual channel availability in the network is still above the threshold level of channel availability;

reattempting delivery of the call, upon determining that the actual channel availability in the network is still above the threshold level of channel availability; and

delaying the system-initiated call until the actual channel availability in the network rises above the threshold level of channel availability, upon determining that the actual channel availability in the network has fallen below the threshold level of channel availability.

5. The method of delivering a system-initiated call of claim 4 further comprising the steps of:

incrementing a call-attempt counter upon each attempted delivery of the call; and

stopping the step of reattempting delivery of the call upon determining that the call-attempt counter equals a predefined maximum number of call attempts.

6. The method of delivering a system-initiated call of claim 4 further comprising the step of measuring a time delay between call attempts, and wherein the step of reattempting delivery of the call includes reattempting delivery of the call, upon determining that the time delay has expired.

7. The method of delivering a system-initiated call of claim 6 further comprising the step of reattempting delivery of the call, upon determining that the mobile station has accessed the network before the time delay expires.

8. A method of delivering a system-initiated call to a called mobile station in a radio telecommunications network comprising the steps of:

setting a priority for each call in the network;

determining whether the system-initiated call is the highest priority call to be delivered;

delivering higher priority calls, upon determining that the system-initiated call is not the highest priority call to be delivered; and

attempting to deliver the system-initiated call, upon determining that the system-initiated call is the highest priority call to be delivered.

9. The method of delivering a system-initiated call of claim 8 wherein the step of setting a priority for each call in the network includes setting a priority based upon each call's revenue-generating potential.

10. The method of delivering a system-initiated call of claim 8 wherein the step of setting a priority for each call in the network includes setting a priority based upon a priority level assigned to each subscriber.

11. The method of delivering a system-initiated call of claim 8 wherein the step of determining whether the system-initiated call is the highest priority call to be delivered includes the steps of:

measuring a time period that the system-initiated call has been queued; and

increasing the priority of the system-initiated call as it ages.

12. The method of delivering a system-initiated call of claim 8 further comprising, before the step of setting a priority for each type of call in the network, the steps of:

setting a threshold level of resource availability in the network;

measuring actual network resource availability; and

determining that the actual network resource availability is below the threshold level of resource availability.

13. The method of delivering a system-initiated call of claim 12 wherein the step of determining whether the system-initiated call is the highest priority call to be delivered is performed continuously, and the method further comprises implementing a time delay for delivering the system-initiated call whenever it is determined that the system-initiated call is not the highest priority call to be delivered.

14. The method of delivering a system-initiated call of claim 8 wherein the system-initiated call is the highest priority call to be delivered, and the method further comprises the steps of:

determining whether the attempted delivery of the system-initiated call was successful; and

implementing a time delay before reattempting to deliver the system-initiated call, upon determining that the delivery of the system-initiated call was not successful.

15. The method of delivering a system-initiated call of claim 14 further comprising the step of attempting to deliver other calls during the time delay.

16. The method of delivering a system-initiated call of claim 14 further comprising the steps of:

determining whether the system-initiated call is still the highest priority call to be delivered when the time delay expires;

delivering higher priority calls, upon determining that the system-initiated call is not the highest priority call to be delivered; and

reattempting to deliver the system-initiated call, upon determining that the system-initiated call is still the highest priority call to be delivered.

FIG. 1

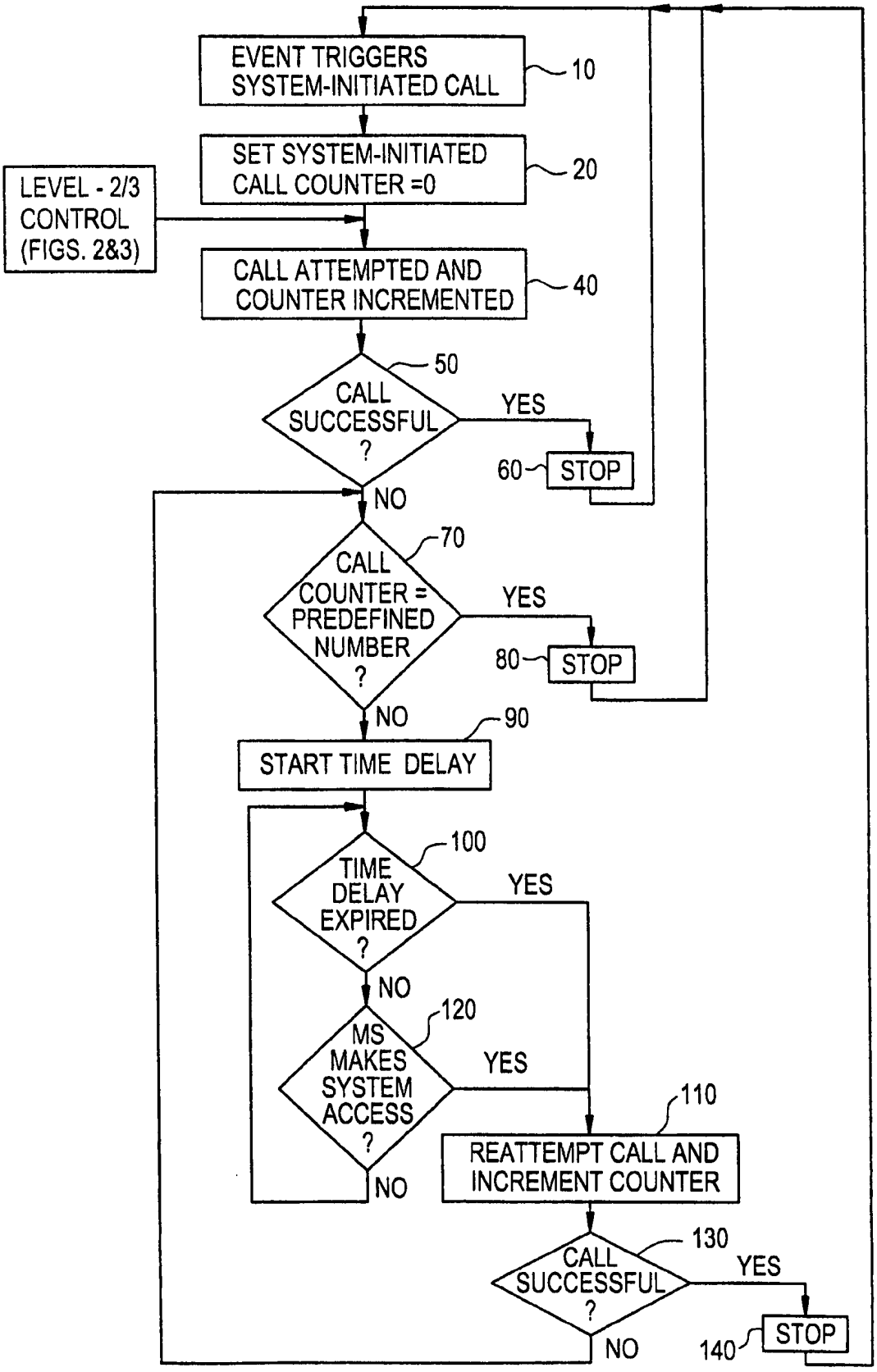

EVENT TRIGGERS SYSTEM-INITIATED CALL
10
SET SYSTEM-INITIATED CALL COUNTER =0
20
LEVEL - 2/3 CONTROL (FIGS. 2&3)
CALL ATTEMPTED AND COUNTER INCREMENTED
40
50
CALL SUCCESSFUL ?
YES
60
STOP
NO
70
CALL COUNTER = PREDEFINED NUMBER ?
YES
80
STOP
NO
90
START TIME DELAY
100
TIME DELAY EXPIRED ?
YES
NO
120
MS MAKES SYSTEM ACCESS ?
YES
NO
110
REATTEMPT CALL AND INCREMENT COUNTER
130
CALL SUCCESSFUL ?
YES
NO
140
STOP

FIG. 2

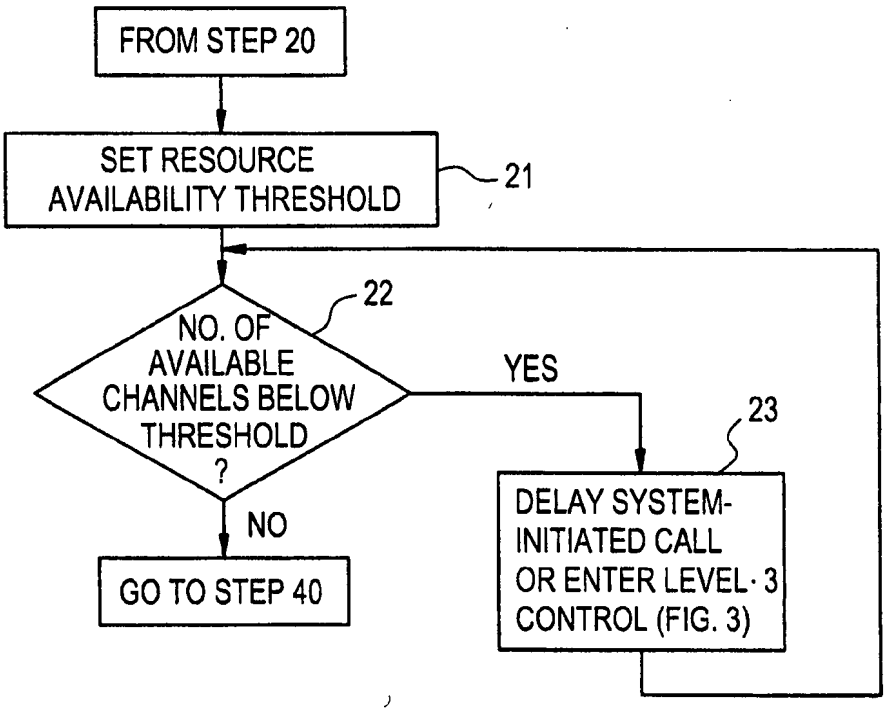
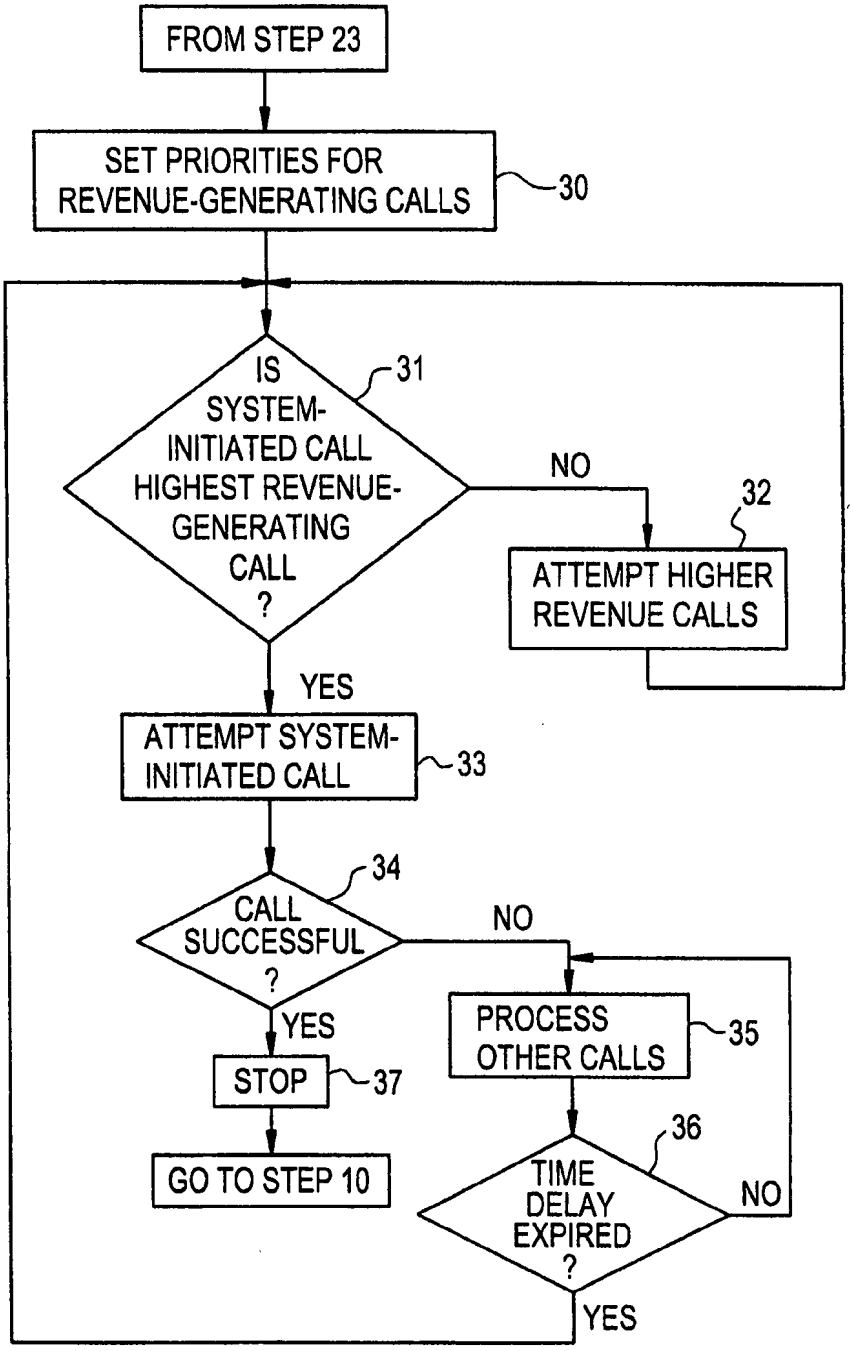

FROM STEP 20
SET RESOURCE AVAILABILITY THRESHOLD
21
22
NO. OF AVAILABLE CHANNELS BELOW THRESHOLD ?
YES
23
NO
GO TO STEP 40
DELAY SYSTEM-INITIATED CALL OR ENTER LEVEL-3 CONTROL (FIG. 3)

FIG. 3


FROM STEP 23
SET PRIORITIES FOR REVENUE-GENERATING CALLS
30
IS SYSTEM-INITIATED CALL HIGHEST REVENUE-GENERATING CALL ?
31
NO
32
ATTEMPT HIGHER REVENUE CALLS
YES
ATTEMPT SYSTEM-INITIATED CALL
33
CALL SUCCESSFUL ?
34
NO
YES
STOP
37
GO TO STEP 10
PROCESS OTHER CALLS
35
TIME DELAY EXPIRED ?
36
NO
YES

INTERNATIONAL SEARCH REPORT

International Application No
PCT/SE 99/00488

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	column 3, line 22 - column 4, line 15 column 6, line 26 - line 31 column 7, line 8 - line 15 column 8, line 13 - column 9, line 62 column 12, line 40 - column 13, line 32	1-3

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 September 1999	20/09/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Gerling, J.C.J.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PC./SE 99/00488

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	REZAIFAR R ET AL: "FROM OPTIMAL SEARCH THEORY TO SEQUENTIAL PAGING IN CELLULAR NETWORKS" IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS, vol. 15, no. 7, 1 September 1997 (1997-09-01), pages 1253-1264, XP000721261 ISSN: 0733-8716 page 1254, paragraph III. - page 1255, paragraph IV. page 1258, paragraph A. - paragraph B. page 1259, paragraph C. - page 1260, paragraph VII.	1-3
A	LYBEROPOULOS G L ET AL: "INTELLIGENT PAGING STRATEGIES FOR THIRD GENERATION MOBILE TELECOMMUNICATION SYSTEMS" IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY, vol. 44, no. 3, 1 August 1995 (1995-08-01), pages 543-553, XP000526045 ISSN: 0018-9545 page 544, paragraph B. - page 545, right-hand column, line 21 page 547, paragraph III. - page 549, paragraph A.	3
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